WHAT IS CLAIMED IS:

1. A wavelength tunable laser comprising:

a gain means with an active emission section that generates light;

a waveguide including a core, the core optically coupled to the active emission section for receiving light, the core having a refractive index, the core including more than one diffraction grating, each diffraction grating having a different Bragg wavelength;

a substrate supporting the waveguide and the gain means;

thermo-optical material adjacent to each diffraction grating, the refractive index of the thermo-optical material adjacent to each diffraction grating is less than the refractive index of the core; and

temperature changing means in the thermo-optical material adjacent to each diffraction grating.

2. The laser of claim 1 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

3. The laser of claim 2 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the

chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

4. The laser of claim 1 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

5. The laser of claim 4 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

6. The laser of claim 3 wherein the off temperature is in the range of -65° to 100° Celsius.

7. The laser of claim 5 wherein the off temperature is in the range of -65° to 100° Celsius.

8. The laser of claim 1 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

9. The laser of claim 8 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the

thermo-optical material positioned in proximity to the phase control section.

10. The laser of claim 9 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

11. A wavelength tunable laser comprising:

a gain means with an active emission section that generates light;

a waveguide including a core, the core optically coupled to the active emission section for receiving light, the core having a refractive index, the core including more than one diffraction grating, each diffraction grating having a Bragg wavelength;

a substrate supporting the waveguide and the gain means, the substrate including an index loading region adjacent to each diffraction grating;

thermo-optical material adjacent to each diffraction grating, the refractive index of the thermo-optical material adjacent to each diffraction grating is less than the refractive index of the core; and

temperature changing means in the thermo-optical material adjacent to each diffraction grating wherein the product of a pitch associated with each diffraction grating and an effective refractive index of an optical mode as the optical mode propagates by each diffraction grating is different for each diffraction grating.

12. The laser of claim 11 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

13. The laser of claim 12 wherein, when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

14. The laser of claim 11 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

15. The laser of claim 14 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

16. The laser of claim 12 wherein the off temperature is in the range of -65° to 100° Celsius.

17. The laser of claim 14 wherein the off temperature is in the range of -65° to 100° Celsius.

18. The laser of claim 11 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

19. The laser of claim 18 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

20. The laser of claim 19 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

21. A wavelength tunable laser comprising:

a gain means with an active emission section that generates light;

a waveguide including a core and material within the waveguide, the core optically coupled to the active emission section for receiving light, the core having a refractive index;

regions of gratings in the waveguide, the regions of gratings including thermo-optical material, the refractive index of the thermo-optical material is less than the refractive index of the core;

a substrate supporting the waveguide and the gain means; and

temperature changing means in the thermo-optical material.

22. The laser of claim 21 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

23. The laser of claim 22 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

24. The laser of claim 21 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except

for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

25. The laser of claim 24 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

26. The laser of claim 23 wherein the off temperature is in the range of -65° to 100° Celsius.

27. The laser of claim 25 wherein the off temperature is in the range of -65° to 100° Celsius.

28. The laser of claim 21 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

29. The laser of claim 28 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

30. The laser of claim 29 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from

styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

31. A wavelength tunable laser comprising:

a gain means with an active emission section that generates light;

a waveguide including a core and material within the waveguide, the core optically coupled to the active emission section for receiving light, the core having a refractive index;

regions of gratings in the waveguide, the regions of gratings including thermo-optical material, the refractive index of the thermo-optical material is less than the refractive index of the core;

a substrate supporting the waveguide and the gain means, the substrate including an index loading region adjacent to each diffraction grating; and

temperature changing means in the thermo-optical material wherein the product of a pitch associated with each diffraction grating and an effective refractive index of an optical mode as the optical mode propagates by each diffraction grating is different for each diffraction grating.

32. The laser of claim 31 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

33. The laser of claim 32 wherein, when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

34. The laser of claim 31 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

35. The laser of claim 34 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

36. The laser of claim 32 wherein the off temperature is in the range of -65° to 100° Celsius.

37. The laser of claim 34 wherein the off temperature is in the range of -65° to 100° Celsius.

38. The laser of claim 31 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

39. The laser of claim 38 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

40. The laser of claim 39 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

41. A wavelength tunable filter comprising:

a waveguide including a core, the core having a refractive index, the core including more than one diffraction grating, each diffraction grating having a different Bragg wavelength;

a substrate supporting the waveguide;

thermo-optical material adjacent to each diffraction grating, the refractive index of the thermo-optical material adjacent to each diffraction grating is less than the refractive index of the core; and

temperature changing means in the thermo-optical material adjacent to each diffraction grating.

42. The filter of claim 41 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

43. The filter of claim 42 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

44. The filter of claim 41 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

45. The filter of claim 44 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

46. The filter of claim 43 wherein the off temperature is in the range of -65° to 100° Celsius.

47. The filter of claim 45 wherein the off temperature is in the range of -65° to 100° Celsius.

48. The filter of claim 41 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

49. The filter of claim 48 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

50. The filter of claim 49 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

51. A wavelength tunable filter comprising:

a waveguide including a core, the core having a refractive index, the core including more than one diffraction grating, each diffraction grating having a Bragg wavelength;

a substrate supporting the waveguide, the substrate including an index loading region adjacent to each diffraction grating;

thermo-optical material adjacent to each diffraction grating, the refractive index of the thermo-optical material adjacent to each diffraction grating is less than the refractive index of the core; and

temperature changing means in the thermo-optical material adjacent to each diffraction grating wherein the product of a pitch associated with each diffraction grating and an effective refractive index of an optical mode as the optical mode propagates by each diffraction grating is different for each diffraction grating.

52. The filter of claim 51 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

53. The filter of claim 52 wherein, when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

54. The filter of claim 51 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except

for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

55. The filter of claim 54 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

56. The filter of claim 52 wherein the off temperature is in the range of -65° to 100° Celsius.

57. The filter of claim 54 wherein the off temperature is in the range of -65° to 100° Celsius.

58. The filter of claim 51 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

59. The filter of claim 58 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

60. The filter of claim 59 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from

styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

61. A wavelength tunable filter comprising:

a waveguide including a core and material within the waveguide, the core optically coupled to the active emission section for receiving light, the core having a refractive index;

regions of gratings in the waveguide, the regions of gratings including thermo-optical material, the refractive index of the thermo-optical material is less than the refractive index of the core;

a substrate supporting the waveguide; and

temperature changing means in the thermo-optical material.

62. The filter of claim 61 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is less than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

63. The filter of claim 62 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

64. The filter of claim 61 wherein, when the temperature of the thermo-optical material adjacent each diffraction grating, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

65. The filter of claim 64 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

66. The filter of claim 63 wherein the off temperature is in the range of -65° to 100° Celsius.

67. The filter of claim 65 wherein the off temperature is in the range of -65° to 100° Celsius.

68. The filter of claim 61 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

69. The filter of claim 68 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

70. The filter of claim 69 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.

71. A wavelength tunable filter comprising:

a waveguide including a core and material within the waveguide, the core optically coupled to the active emission section for receiving light, the core having a refractive index;

regions of gratings in the waveguide, the regions of gratings including thermo-optical material, the refractive index of the thermo-optical material is less than the refractive index of the core;

a substrate supporting the waveguide, the substrate including an index loading region adjacent to each diffraction grating; and

temperature changing means in the thermo-optical material wherein the product of a pitch associated with each diffraction grating and an effective refractive index of an optical mode as the optical mode propagates by each diffraction grating is different for each diffraction grating.

72. The filter of claim 71 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is less than an off temperature, the magnitude of

the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

73. The filter of claim 72 wherein, when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or greater than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

74. The filter of claim 71 wherein, when the temperature of the thermo-optical material adjacent to each diffraction gratings, except for a chosen diffraction grating, is greater than an off temperature, the magnitude of the light reflected by each diffraction grating, except for the chosen diffraction grating, is insufficient to cause single mode lasing of the wavelength tunable laser.

75. The filter of claim 74 wherein when the temperature of the thermo-optical material adjacent to the chosen diffraction grating is equal to or less than the off temperature, the magnitude of the light reflected by the chosen diffraction grating is sufficient to cause single mode lasing of the wavelength tunable laser.

76. The filter of claim 72 wherein the off temperature is in the range of -65° to 100° Celsius.

77. The filter of claim 74 wherein the off temperature is in the range of -65° to 100° Celsius.

78. The filter of claim 71 wherein the core includes a diffraction grating-free portion, the diffraction grating-free portion including a phase control section.

79. The filter of claim 78 further comprising thermo-optical material positioned in proximity to the phase control section and temperature changing means in the thermo-optical material positioned in proximity to the phase control section.

80. The filter of claim 79 wherein the thermo-optical material is selected from the group comprising a polymer derived from methacrylate, a polymer derived from siloxane, a polymer derived from carbonate, a polymer derived from styrene, a polymer derived from cyclic olefin, and a polymer derived from norbornene.